

NOTIFICATION OF ADDENDUM

ADDENDUM NO. 1

DATED 8/28/2002

Control	0923-06-047
Project	STP 2000(540)TE
Highway	VA
County	BROWN

Ladies/Gentlemen:

Attached please find an addendum on the above captioned project. Included in the attachment is an addendum notification which details the changes and the respective proposal pages which were added and/or changed.

Except for new bid insert pages, it is unnecessary to return any of the pages attached.

Bid insert pages must be returned with the bid proposal submitted to the Department, unless your firm is submitting a bid using a computer print out. The computer print out must be changed to reflect the new bid item information.

Contractors and material suppliers, etc. who have previously been furnished informational proposals are not being furnished a copy of the addendum. If you have a subcontractor on the above project, please advise them of this addendum. Acknowledgment of this addendum is not requested if your company has been issued a proposal stamped "This Proposal Issued for Informational Purposes."

You are required to acknowledge receipt of this addendum by entering the date, which appears at the top of this letter on the Addendum Acknowledgement Form, contained in your bid proposal.

Failure to Acknowledge receipt of this addendum in your bid proposal will result in your bid not being read.

04/99

SUBJECT: PLANS AND PROPOSAL ADDENDUMS

PROJECT: STP 2000(540)TE

CONTROL: 0923-06-047

COUNTY: BROWN

LETTING: 09/05/2002

REFERENCE NO: 0823

PROPOSAL ADDENDUMS

— PROPOSAL COVER

— BID INSERTS (SH. NO.:)

— GENERAL NOTES (SH. NO.:)

X SPEC LIST (SH. NO.: 1-2)

X SPECIAL PROVISIONS:

ADDED: 002---073

DELETED:

— SPECIAL SPECIFICATIONS:

ADDED:

DELETED:

X OTHER: WAIVER STATUS OF PROJECT

DESCRIPTION OF ABOVE CHANGES

(INCLUDING PLANS SHEET CHANGES)

THIS PROJECT IS BEING LET AS A WAIVED PROJECT.

THIS PROJECT WAS ORIGINALLY SUBMITTED AS A NON-WAIVED PROJECT.

BID INSERT: PAGE 1: ADDING SP002---073 DUE TO THIS PROJECT NOW BEING
WAIVED.

CONTROL : 0923-06-047
PROJECT : STP 2000(540)TE
HIGHWAY : VA
COUNTY : BROWN

TEXAS DEPARTMENT OF TRANSPORTATION

GOVERNING SPECIFICATIONS AND SPECIAL PROVISIONS

ALL SPECIFICATIONS AND SPECIAL PROVISIONS APPLICABLE TO THIS PROJECT
ARE IDENTIFIED AS FOLLOWS:

STANDARD SPECIFICATIONS: ADOPTED BY THE TEXAS DEPARTMENT OF
----- TRANSPORTATION MARCH 1, 1993.
STANDARD SPECIFICATIONS ARE INCORPORATED
INTO THE CONTRACT BY REFERENCE.

ITEMS 1 TO 9 INCL., GENERAL REQUIREMENTS AND COVENANTS

SPECIAL PROVISIONS: SPECIAL PROVISIONS WILL GOVERN AND TAKE
----- PRECEDENCE OVER THE SPECIFICATIONS ENUMERATED
HEREON WHEREVER IN CONFLICT THEREWITH.

REQUIRED CONTRACT PROVISIONS, FEDERAL-AID CONSTRUCTION CONTRACTS
(FORM FHWA 1273, DECEMBER, 1993)

WAGE RATES

SPECIAL PROVISION "STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS" (000---001)
SPECIAL PROVISION "NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO
ENSURE EQUAL EMPLOYMENT OPPORTUNITY" (000--1981)
SPECIAL PROVISION "CERTIFICATION OF NONDISCRIMINATION IN
EMPLOYMENT" (000---003)
SPECIAL PROVISION "SCHEDULE OF LIQUIDATED DAMAGES" (000--3352)
SPECIAL PROVISION "OPTIONAL TRAINING" (000--3487)
SPECIAL PROVISION "DISADVANTAGED BUSINESS ENTERPRISE IN FEDERAL-AID
CONSTRUCTION" (000--2458)
SPECIAL PROVISION "NOTICE TO ALL BIDDERS" (000---482)
SPECIAL PROVISION "PARTNERING" (000--2169)
SPECIAL PROVISION TO ITEM 1 (001---179)
SPECIAL PROVISIONS TO ITEM 2 (002---073) (002---102)
SPECIAL PROVISION TO ITEM 3 (003---065)
SPECIAL PROVISION TO ITEM 4 (004---014)
SPECIAL PROVISION TO ITEM 5 (005---027)
SPECIAL PROVISION TO ITEM 6 (006---018)
SPECIAL PROVISION TO ITEM 7 (007---783)

SPECIAL PROVISIONS TO ITEM 8 (008---117) (008---244)
SPECIAL PROVISION TO ITEM 9 (009---062)

SPECIAL SPECIFICATIONS:

ITEM 5004 TEMPORARY EROSION, SEDIMENTATION AND WATER POLLUTION
 PREVENTION AND CONTROL
ITEM 5903 RESTORATION OF HARVEY HOUSE

GENERAL: THE ABOVE-LISTED SPECIFICATION ITEMS ARE THOSE UNDER WHICH
----- PAYMENT IS TO BE MADE. THESE, TOGETHER WITH SUCH OTHER
 PERTINENT ITEMS, IF ANY, AS MAY BE REFERRED TO IN THE ABOVE-
 LISTED SPECIFICATION ITEMS, AND INCLUDING THE SPECIAL
 PROVISIONS LISTED ABOVE, CONSTITUTE THE COMPLETE SPECIFI-
 CATIONS FOR THIS PROJECT.

SPECIAL PROVISION

002---073

Instructions to Bidders

For this project, Item 002, "Instructions to Bidders," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 2.4. Competency of Bidders is voided and replaced by the following:

2.4. Competency of Bidders. The bidder must be capable of performing the work bid upon and shall submit prior to requesting a bidding proposal, a completed "Bidders Questionnaire", along with any additional information requested in that form. The "Bidders Questionnaire" form may be obtained from the Construction Division, Texas Department of Transportation, Austin, Texas 78701.

The "Bidders Questionnaire", once filed and approved by the Department enables the Contractor to bid on contracts on which prequalification is waived. The "Bidders Questionnaire" must be filed at least ten (10) days prior to the date upon which bids are to be submitted and is good for a one (1) year period. Forms for resubmission will be provided the month before the anniversary date of the latest approved Bidder's Questionnaire.

CONTRACTORS NOW PREQUALIFIED WITH THE DEPARTMENT WILL NOT BE REQUIRED TO MAKE THE SPECIAL SUBMISSIONS HEREIN LISTED.

NOTIFICATION OF ADDENDUM

ADDENDUM NO. 2

DATED 8/30/2002

Control	0923-06-047
Project	STP 2000(540)TE
Highway	VA
County	BROWN

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04/99

SUBJECT: PLANS AND PROPOSAL ADDENDUMS

PROJECT: STP 2000(540)TE

CONTROL: 0923-06-047

COUNTY: BROWN

LETTING: 09/05/2002

REFERENCE NO: 0830

PROPOSAL ADDENDUMS

— PROPOSAL COVER

— BID INSERTS (SH. NO.:)

— GENERAL NOTES (SH. NO.:)

— SPEC LIST (SH. NO.:)

— SPECIAL PROVISIONS:

ADDED:

DELETED:

— SPECIAL SPECIFICATIONS:

ADDED:

DELETED:

X OTHER: ATTACHMENT TO SPECIAL SPECIFICATION 5903

DESCRIPTION OF ABOVE CHANGES

(INCLUDING PLANS SHEET CHANGES)

DIVISION 16 "ELECTRICAL"
16511, 16521.

ADDED SECTIONS 16050, 16060, 16130, 16140

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Examine and coordinate with all Contract Drawings and Specifications and all addenda issued.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Concrete equipment bases.
 - 6. Electrical demolition.
 - 7. Cutting and patching for electrical construction.
 - 8. Touchup painting.

1.3 SCOPE OF WORK

- A. The work covered by Division 16 comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for and reasonably incidental to, the installation of the work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.
- B. The scope includes the following:
 - 1. Demolition, removal, and new construction for the Harvey House Building.
 - 2. Renovations to the power distribution in the Plaza and the Harvey House Building.
 - 3. New receptacles in the existing Meeting Building.
 - 4. Demolition as described on the Drawings and in Paragraph 1.13 of this Section.
- C. Refer to other Divisions of the Specifications for related work.

1.4 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. RGS: Rigid galvanized steel conduit.
- D. LFMC: Liquidtight flexible metal conduit.

1.5 REFERENCE STANDARDS

- A. Provide the materials and perform the work in conformance with the ordinances and regulations of all authorities having jurisdiction.
- B. Obtain and pay for all permits, plan checks, inspections and approvals required by the regulatory authorities.
- C. Comply with standards and requirements of local utility companies.
- D. The work shall be in accordance with, but shall not be limited to, the standards or requirements of:
 - 1. National Fire Protection Association (NFPA).
 - 2. National Electrical Code (NEC).
 - 3. Life Safety Code (NFPA 101, 1994).
 - 4. National Electrical Manufacturers Association (NEMA).
 - 5. Texas Accessibility Act Standards (TAS).
 - 6. Local and city codes and ordinances.
- E. Codes and standards referred to are minimum standards. Where the requirements of the Drawings or Specifications exceed those of the codes and regulations, the Drawings and Specifications shall govern.

1.6 MATERIALS, EQUIPMENT AND DEVICES

- A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.
- B. Specific manufacturers and model numbers are listed to establish a level of quality and not intended to limit competitive bidding.
- C. Space allocations for materials, equipment and devices are made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices fit within the constraints of the allocated space.

1.7 DRAWINGS AND SPECIFICATIONS

- A. Work called for in either the Drawings or the Specifications shall be treated as though called for by both.
- B. Should the requirements of the Drawings and Specifications conflict, the Contractor's pricing shall be based on the more expensive requirement.
- C. Any conflicts shall be reported to the Owner's Representative immediately and prior to any work being performed.
- D. The Drawings are diagrammatic. Determine exact locations and routes by reference to the submittal, shop drawings, and measurements at the site. Make minor changes in equipment and device locations as necessary for construction conditions or directed by the Owner's Representative without additional cost to the Owner.
- E. Prepare installation drawings as required for coordination with building structures or the work of other Divisions, before the work proceeds.

1.8 SUBMITTALS

- A. Product Data: For electricity equipment.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Six (6) copies of equipment and material submittals, for approval by the Architect/Engineer firm, shall be submitted prior to shipment and release for fabrication at the manufacturing source. Submittals shall be bound with cover page, title page, indexed, and sectioned for the equipment and materials furnished. In addition, four (4) copies of maintenance and operating instructions shall be submitted for the permanent records and use of the State prior to substantial completion of the project.

1.9 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Materials, equipment and devices shall be new, of the quality specified and shall be free from defects, replace any defective materials, equipment and devices with new specified items.
- C. Comply with NFPA 70.

1.10 CONTRACTOR'S QUALIFICATIONS

- A. All electrical work shall be performed by an electrician holding at least a current Journeyman Electrician License under the general supervision of an electrician holding a Masters Electrician License.
- B. The Contractor shall provide evidence of required licensing including expiration dates when so requested by the State's Representative.
- C. All workers shall be required to be thoroughly experienced in the particular class of work for which they are employed.
- D. All work performed by the Contractor shall be professional in design, equipment selection and installation.

1.11 SUBSTITUTIONS

- A. It is not the intent of the Drawings and/or Specifications to limit products to any particular manufacturer nor to discriminate against an "APPROVED EQUAL" product as produced by another manufacturer. Some proprietary products may be mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. On the other hand, when a manufacturer's name appears in these Specifications or in the Drawings, it shall not be interpreted that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).
- B. The specified products have been used in preparing the Drawings and Specifications and thus establish minimum qualities with which substitutes must be at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the Engineer is final.
- C. Substitutions or deviations shall only be made by specific request by the Contractor. The Uniform General Conditions also require that the Contractor make requests for "specific deviations" from the Construction Documents.
- D. Should the Contractor desire to furnish substitutions of specified products, they shall furnish to the State full technical data, physical size and specifications at least fourteen (14) working days prior to the bid closing date and receive written approval from the State Representative. Submit a separate request for each substitution, support each request with two copies of submittal including physical and performance data. The Company waives claims for additional cost incurred from substitutions. Approved substitutions will be itemized in an addendum issued five (5) working days prior to the established bid date and a written notice will be issued to the Contractor indicating acceptance. For substitutions not approved, a written notice shall be issued to the Contractor indicating rejection.

1.12 WORKMANSHIP AND INSTALLATION

- A. The NECA "Standards of Installation" as published by the National Electrical Contractors Association shall be considered a part of these Specifications, except as specifically modified by other provisions contained in these Specifications.
- B. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report same to the Owner's Representative and shall secure his approval before the work is started.

1.13 DEMOLITION

- A. Reference Architectural drawings for pictures of existing conditions and extent of demolition. Remove all existing exposed and abandoned devices and conduit.
- B. Carefully remove electrical equipment so as to not damage existing finish.
- C. Study the complete set of Contract Documents and become familiar with requirements in areas where existing construction will be restored.

1.14 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
- B. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in other divisions.
- C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

- D. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. EMT: ANSI C80.3, zinc-coated steel, set screw not acceptable.
- B. FMC: Zinc-coated steel.
- C. RGS: ANSI C80.6, zinc-coated steel, with threaded fittings.
- D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
- F. Raceway Fittings: Specifically designed for the raceway type with which used.

2.2 CONDUCTORS

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
- B. Conductors, Larger Than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic, rated at 75 deg C minimum, Type THHN or THWN.
- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.3 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, and wall brackets.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Expansion Anchors: Carbon-steel wedge or sleeve type.
- G. Toggle Bolts: All-steel springhead type.
- H. Powder-Driven Threaded Studs: Heat-treated steel.

2.4 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.
- C. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
- D. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.5 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: 3000-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.6 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.7 SAFETY DISCONNECT SWITCHES

- A. Switches shall be manufactured in accordance with the following standards:
 - 1. NEMA KSI – Enclosed switches.
 - 2. NEMA 250 – Enclosures for Electrical Equipment.
- B. Type: Heavy duty.
- C. Rated: NEMA1 for interior and NEMA 3R for exterior.
- D. Acceptable manufacturers:
 - 1. Square D.
 - 2. General Electric.
 - 3. Cutter Hammer.

2.8 PANELBOARDS

- A. Enclosure: NEMA PB1, Type 1 flush or surface mounted cabinets indoors. NEMA 250, Type 3R outdoors.
- B. Bus: Hard-drawn copper and equipment ground bus.
- C. Overcurrent Protection: Molded case, plug-in circuit breakers, NEMA AB1 with interrupting capacity to meet available fault currents.
- D. Directory Card: Mounted inside panelboard door, in metal frame with transparent protective cover.
- E. Doors: With concealed hinges, flush latch tumbler lock, keyed alike.
- F. Acceptable Manufacturers:
 - 1. Square D Co.
 - 2. General Electric Co.
 - 3. Cuttler Hammer.

2.9 LIGHTING CONTROLS

- A. Multi-Pole Lighting Contactor: Mechanically held and electrically operated with encapsulated coils; totally enclosed double-break silver-cadmium-oxide power contacts; in ANSI/NEMA ICS6, Type 1 or 3R enclosure to meet installation conditions.
- B. Photoelectric Relays: Solid-state, single-pole, double-throw dry contacts rated to operate connected relay or contactor coils; adjustable switch level over light-level monitoring range of 0 to 3500 fc with time delay to prevent false operation in outdoor sealed unit of weathertight, high temperature resistant housing equipped with sun-glare shield and ice preventer.
- C. Time Switch: Solid-state programmable with alphanumeric display complying with UL 917 operating in conjunction with photoelectric relay to provide four (4) circuits of control.
- D. Acceptable Manufacturers:
 - 1. Tork, Inc.
 - 2. Paragon.
 - 3. Leviton.
 - 4. Zenith.
 - 5. Approved equal.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY APPLICATION

- A. Use the following raceways for outdoor installations:
 - 1. Exposed: RGS.
 - 2. Concealed: RGS.
 - 3. Underground, Single Run: RNC.
 - 4. Underground, Grouped: RNC.
 - 5. Connection to Vibrating Equipment: LFMC.
 - 6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Use the following raceways for indoor installations:
 - 1. Exposed: EMT.
 - 2. Concealed: EMT.
 - 3. Connection to Vibrating Equipment: LFMC.
 - 4. Damp or Wet Locations: RGS.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.3 RACEWAY INSTALLATION

- A. Conceal raceways, unless otherwise indicated, within finished walls, ceilings, and floors.
- B. Install raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- C. Use temporary raceway caps to prevent foreign matter from entering.
- D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- E. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- F. Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- G. Connect motors and equipment subject to vibration, noise transmission, or movement with a minimum of 18-inch and a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.
- H. Set floor boxes level and trim after installation to fit flush to finished floor surface.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

- A. Feeders: Type THHN/THWN insulated conductors in raceway.
- B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.
- C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.
- D. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.5 WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.6 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials.
- B. Dry Locations: Steel or malleable iron materials.
- C. Selection of Supports: Comply with manufacturer's written instructions.

- D. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.7 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- H. Simultaneously install vertical conductor supports with conductors.
- I. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- J. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- K. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- L. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.8 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:
 - 1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.

2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
 3. Colors: As follows:
 - a. Fire Alarm System: Red.
 - b. Security System: Blue and yellow.
 - c. Emergency Power System: Green.
 - E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
 - F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.
 - G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 1. Phase A: Black.
 2. Phase B: Red.
 3. Phase C: Blue.
 - H. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 - I. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- 3.9 UTILITY COMPANY SERVICES
- A. Coordinate with Utility Company for modifications to the existing services. The existing building service is 120/208 volt, 3-phase, 4-wire while the service to the Plaza is 120/240 volt, single-phase.
- 3.10 FIRESTOPPING
- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."
- 3.11 CONCRETE BASES
- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- 3.12 FIELD QUALITY CONTROL
- A. Inspect installed components for damage and faulty work, including the following:
 1. Raceways.
 2. Building wire and connectors.
 3. Supporting devices for electrical components.
 4. Electrical identification.
 5. Concrete bases.
 6. Electrical demolition.
 7. Cutting and patching for electrical construction.
 8. Touchup painting.

3.13 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.14 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

End of Section

SECTION 16060 - GROUNDING AND BONDING

PART 4 - GENERAL

4.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Comply with Division Sections, as applicable. Refer to other Divisions for coordination of work.

4.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include the following:
 - 1. Division 13 Section "Lightning Protection" for additional grounding and bonding materials.
- C. Provide labor, materials, equipment, tools and service, and perform operations required for, and reasonably incidental to, the providing of the grounding systems.
- D. Exposed metallic parts of the electrical system which are not intended to carry current, including system components such as busducts, switchboards, panelboards, and raceway systems, and including grounding conductors and neutral conductors of the various wiring systems, shall be grounded in accordance with NEC requirements.
- E. All grounding systems shall comply with applicable State and Local Codes and Ordinances, with the requirements of other Authorities having jurisdiction, with NEC and applicable NFPA Standards.

4.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Data: For the following:
 - 1. Ground rods.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Submit written test reports to include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

4.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.
- B. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 5 - PRODUCTS

5.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Chance/Hubbell.
 - b. Copperweld Corp.
 - c. Framatome Connectors/Burndy Electrical.
 - d. Harger Lightning Protection, Inc.
 - e. Heary Brothers Lightning Protection Co.

- f. Kearney/Cooper Power Systems.
- g. Lightning Master Corp.
- h. Lyncole XIT Grounding.
- i. O-Z/Gedney Co.; a business of the EGS Electrical Group.
- j. Raco, Inc.; Division of Hubbell.
- k. Thomas & Betts, Electrical.

5.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Material: Grounding Conductors shall be annealed copper stranded conductors. Conductor shall be bare or insulated, as required or indicated, and of the sizes indicated or required by the NEC.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

5.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Provide exothermic type chemical welded type connectors for joining of grounding electrode conductors to ground rods, grounding plates and splicing of conductors. Provide compression and bolted type connectors for joining of grounding electrode conductors to ground bars.
- C. Provide mechanical type connectors for joining of all equipment and isolated ground conductors.

5.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4 inch diameter 10 feet long designed for driven installation.

PART 6 - EXECUTION

6.1 APPLICATION

- A. Provide adequate and permanent service neutral and equipment grounding in accordance with the National Electrical Code and subject to the following additional requirements.
- B. Size grounding conductors in accordance with Tables 250-94 and 250-95 of the NEC.
- C. Connect the service neutral and equipment ground to a common point within the metallic enclosure containing the main service disconnecting means. Equipment grounds and the identified neutral of the wiring system shall not be interconnected beyond this point in the interior wiring system. From the common point of connection of the service neutral and the equipment ground, run in non-magnetic conduit a grounding electrode conductor without joint or splice to the grounding electrode system and connect it thereto with an approved bolted pressure clamp.

- D. The grounding electrode system shall be formed by bonding together the following to the main service ground bus a #3/0 green insulated "THWN" copper ground conductor in non-magnetic conduit to provide a common grounding electrode system.
 - 1. Underground main metallic water pipe, connect ahead of the first valve, provide a bonding jumper across water meter (in accordance with NEC 250-81a).
 - 2. Structural steel building frame, connect to nearest vertical member originating at a footing (in accordance with NEC 250-81b).
 - 3. Where the above electrodes are not available or feasible, provide suitable grounding electrodes as specified in National Electrical Code, Article 250-83.
- E. Assure the electrical continuity of all metallic raceway systems, pulling up all conduits and/or locknuts wrench-tight. Where expansion joints or telescoping joints occur, provide bonding jumpers. Wherever flexible metallic conduit is employed, provide a green insulated ground jumper installed in the flexible conduit.
- F. Provide grounding bushings on all raceways terminating within all electrical enclosures constructed of separate enclosure panels which are not integrally welded together. Provide grounding conductors from such bushings to the frame of the enclosure, ground bus and equipment grounding strap where one occurs.
- G. Provide a separate green-insulated equipment grounding conductor, with insulation of the same rating as the phase conductors, for all feeders and branch circuits. Install the grounding conductors in the raceway with related phase and neutral conductors. Where parallel conductors in separate raceways occur, provide a grounding conductor in each raceway. Connect all grounding conductors to ground terminals at each end of the run, to the end that there will be no uninterrupted grounding circuit from the point of ground fault back to a point of connection of the equipment ground and system neutral.
- H. Connect the secondary neutral point and the enclosure in each dry type transformer together and run a grounding electrode conductor from their common point of connection to the building grounding electrode system.
- I. Panelboard Bonding: The equipment grounding terminal busses of the normal and essential branch circuit panelboards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not smaller than No. 6 where more than two panels serve the same location. This conductor shall be continuous from panel to panel, but shall be permitted to be broken in order to terminate on the ground bus in each panel.

6.2 FIELD QUALITY CONTROL

- A. Perform the following tests:
 - 1. Test the continuity of, and the proper connection of, each ground conductor and system, to assure that the grounding system is complete and uninterrupted. Testing shall be performed using laboratory-accuracy test instruments of suitable design for the tests to be performed. Test instruments shall be provided under Division 16.
 - 2. Make proper notification of testing dates and times in writing to the Owner so that he may, at his discretion, witness any of the tests. A complete record of each test shall be recorded, including the time and date of test, and the time and date submitted for acceptance.
 - 3. Test grounding conductors, phase conductors and neutral conductors for continuity and for possible damage to insulation. Each such conductor shall be tested for insulation from ground and from other conductors.
- B. Any portions of the installations which fail to pass these tests shall be replaced, repaired or otherwise corrected to the satisfaction of the Owner's Representative, and completely retested to show proper conformity.

6.3 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed.

End Of Section

SECTION 16130 - RACEWAYS AND BOXES

PART 7 - GENERAL

7.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Comply with Division 16 Sections, as applicable. Refer to other Divisions for coordination of work.

7.2 SUMMARY

- A. Provide labor, materials, equipment, tools and services, and perform operation required for, and reasonable incidental to, the providing of all raceway systems included in this Project.

7.3 DEFINITIONS

- A. EMT (Electrical metallic tubing): EMT shall be constructed of high-grade steel, manufactured specifically to standards assuring maximum welding characteristics and ductility. EMT shall conform in all respects to Federal Specification WW-C-563-A, ANSI C80-3 and UL 797. The exterior galvanized coat of zinc shall be of uniform thickness applied by the electro-galvanized process. The interior surface of each tube shall be uniformly coated with a thick, tough, elastic coating of enamel. EMT shall be dipped in chromic acid bath so as to form a corrosion resistant protective coating of zinc chromate over the galvanized surface.
- B. FMC (Flexible metal conduit): Shall be manufactured of spirally-wound, mild steel strip material having a hot-dip galvanized coating and meeting requirements of UL 1 for flexible metal conduit.
- C. IMC (Intermediate metal conduit): IMC shall be constructed of high-grade steel tubing, galvanized inside and outside and conforming in all respects with Federal Specification WW-C-581-E and UL 1242. Zinc coating shall be applied by the hot-dip, galvanized process and shall be of uniform thickness not only on the inside and outside surfaces of the conduit, but also on the threads of the conduit. Each conduit length shall be equipped with a coupling on one end and a thread protector on the other end.
- D. LFMC (Liquidtight flexible metal conduit): Shall be manufactured exactly as specified for flexible metal conduit and, in addition, shall have a copper grounding strand and factory-applied neoprene jacket. Liquidtight flexible conduit shall meet the requirements of UL 360. For branch circuits in raised floor areas, provide blue or gray jacketed liquidtight flexible conduit.
- E. RNC (Rigid nonmetallic conduit): Rigid nonmetallic conduit shall be polyvinyl chloride (PVC). PVC conduit shall be rigid, Schedule 40, heavy-wall, high-impact, conforming in all respects to the applicable requirements of Federal Specification W-C-1094-A, NEMA TC-2, and UL 651. PVC conduit shall be joined with PVC couplings of the solvent cement type to provide complete watertight joints. Conduit systems shall be UL listed for direct burial and exposed use, and shall be in conformance with the NEC.
- F. GRC (Galvanized rigid steel conduit): Rigid steel conduit shall be galvanized, constructed of high-grade raw steel piping, galvanized inside and outside, conforming in all respects with Federal Specification WW-C-581-E, ANSI C80-1, and UL 6. Zinc coating shall be applied by the hot-dip, galvanized process and shall be of uniform thickness not only on the inside and outside surfaces of the conduit, but also on the threads of the conduit. Conduit shall be dipped in a chromic acid bath so as to form a corrosion-resistant protective coating of zinc chromate over the hot-dipped galvanized surface. Each conduit length shall be threaded and equipped with a coupling on one end and a thread protector on the other end.

7.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets in accordance with Division 1 for products specified under PART 2 - PRODUCTS.

7.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

7.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 8 - PRODUCTS

8.1 COUPLINGS AND TERMINATORS

- A. For Galvanized Rigid Steel and Intermediate Metal Conduit: Shall be factory-made threaded couplings of same material as the conduit.
 - 1. Molded nylon insulating bushing at all boxes and cabinets, with locknuts inside and outside box or cabinet. In wet locations, watertight hubs shall be used for conduit entry into enclosures.
 - 2. Nylon insulated grounding bushing on all conduits where grounding bushings are required with locknuts inside and outside the enclosure. In wet locations, watertight hubs shall be used for conduit entry into enclosures.
- B. For Electrical Metallic Tubing:
 - 1. Steel compression couplings.
 - 2. Steel box connectors with nylon insulated grounding bushing, or box connector locknut, and nylon insulated grounding bushing on all tubing where grounding bushings are required.
 - 3. Set screw couplings are not acceptable.
- C. For Flexible Metal Conduit:
 - 1. Couplings at connections between flexible and rigid conduit.
 - 2. Nylon insulated throat, steel connectors at box or cabinet terminations.
- D. For Liquidtight Flexible Metal Conduit:
 - 1. Adapters at connections between flexible and rigid conduit.
 - 2. Nylon insulated throat, steel connectors at box or cabinet terminations.
- E. Expansion Joints in Conduit: O.Z./Gedney, Type AX with internal ground and external bonding jumper.
- F. Wire Support Bushings: Provide for vertical runs as required by the NEC. Select for the conductor size involved.
 - 1. For conductors No. 8 AWG and smaller, provide galvanized, non-insulating type.
 - 2. For conductors No. 6 AWG and larger, provide O.Z./Gedney, Type R, insulating type.

8.2 JUNCTION AND PULL BOXES

- A. Junction and pull boxes 100 cubic inches in volume and smaller shall be standard outlet boxes. Larger junction and pull boxes shall be constructed from code gauge sheet steel with overlapped riveted or welded corners and with edges turned to receive trim. Covers shall be same gauge as box and shall be screw fastened. Boxes over 864 square inches shall be sectionalized. Boxes shall be factory-fabricated from galvanized steel to prevent corrosion.
- B. Size boxes in accordance with the requirements of the NEC. Boxes shall be no smaller than 4 inches square and 1-1/2 inches deep with covers accessible at all times. Set boxes on concealed conduits with covers flush with the finished wall or ceiling line. Provide junction and pull boxes of appropriate dimensions for conduits and conductors noted, where shown and where necessary for the installation and pulling of cables and wires. Install covers on junction boxes and condulets after wiring and connections are completed.

8.3 OUTLET BOXES

- A. Outlet boxes shall be UL listed, and of sizes and types required for the application.
- B. Boxes Recessed in Construction: Sheet steel boxes, unless noted or required otherwise. Boxes shall be no lighter than 14 gauge and shall be galvanized after fabrication. Set so face of box will finish flush with building surface.
 - 1. For Lighting Fixture Outlets: 4 inch square with raised fixture ring.
 - 2. For Wall Switches, Receptacles, and Communication Use: 4 inch square, one-piece; section boxes permitted. Use boxes with plaster rings in all plastered walls where wall thickness permits. Use boxes less than 1-1/2 inch deep only in locations where deep boxes cannot be accommodated by construction.
- C. Boxes Used Outdoors or in Damp/Wet Locations: Cast metal boxes (iron and alloy) with gasketed covers and threaded hubs.

8.4 PULL CORD (OR WIRES)

- A. Provide a nylon cord, with a tensile strength of not less than 200 pounds, in each empty conduit to facilitate the future installation of conductors. Plastic tags shall be incorporated for identification.

8.5 WIREWAYS AND AUXILIARY GUTTERS

- A. Wireways shall be constructed in accordance with UL 870. Every component including lengths, connectors, and fittings shall be UL listed and labeled. Provision shall be included in the construction to allow screwing the hinged cover closed without the use of parts other than the standard lengths, fittings, and connectors. It shall also be possible to seal the cover in the closed position with a sealing wire.
- B. Wireways shall be constructed with/without knockouts, as required. Enclosure type shall be as required by conditions encountered.
- C. Gutters and Wireways shall be suitable for "lay-in" conductors. Connector covers shall be permanently attached so that removal is not necessary to utilize the lay-in feature.
- D. All sheet metal parts shall be provided with a rust-inhibiting phosphatizing coating and gray baked enamel finish. All hardware shall be plated to prevent corrosion. All screws installed toward the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.
- E. All connectors shall be slip-in type with self-retained mounting screws. All hangers shall be two-piece with hook-together feature to permit pre-assembly of wireway and hanger bottom plate before hanging on pre-installed upper bracket.

8.6 SURFACE METAL RACEWAY

- A. Surface metal raceway shall be UL listed and labeled; shall be used together with couplings, clips, bushings, straps, connectors, connection covers, elbows, boxes, extension boxes, fixture boxes, extension adapters, blank covers and all other required fittings; and shall be of the proper size to accommodate the conductors to be installed therein in each case.

PART 9 - EXECUTION

9.1 RACEWAY APPLICATION

- A. Outdoors:
 - 1. Underground:
 - a. Direct buried: PVC.
 - 2. Exposed:
 - a. All locations (wet): GRC, IMC, Liquidtight Flex.
- B. Within Building Crawl Space:
 - 1. Underground – direct buried: PVC.
 - 2. Exposed – tele/data: EMT with watertight fittings.
 - 3. Exposed – power: EMT with watertight fittings.
- C. Within Building Structure:
 - 1. Exposed:

- a. Subject to physical damage: GRC, IMC.
 - b. Wet locations: GRC, IMC, Liquidtight Flex.
 - c. Damp locations: IMC, Liquidtight Flex.
 - d. Dry locations: EMT, Metal Flex.
 - e. Vertical drops to equipment: EMT.
 - f. Connections to equipment: Metal Flex, Liquidtight Flex.
2. Concealed:
- a. Underground – below slab: PVC.
 - b. In slab on grade – 1" maximum: PVC.
 - c. In slab above grade – 1" maximum: PVC.
 - d. In concrete columns/walls: PVC.
 - e. In masonry walls: PVC.
 - f. In drywall partitions: EMT, Metal Flex.
 - g. Above ceilings: EMT, Metal Flex.
 - h. Below raised floors: EMT, Liquidtight Flex.

9.2 INSTALLATION OF UNDERGROUND CONDUIT

- A. Install underground conductors in rigid non-metallic conduit (PVC), unless noted or specified otherwise. Install at least 30 inches below finished grade, unless noted otherwise, on a bed of sand not less than 3 inches deep. Cover raceways with 9 inches of sand before continuing backfill. Assemble and install raceways in accordance with manufacturer's instructions. Make joints with couplings and solvent welding cement. Fabricate long radius bends with proper heating equipment. Bends showing signs of overheating or flattening are unacceptable. Bends less than 10 feet radius shall be made with rigid steel as described herein. Ream ends of all conduit before joining.
- B. Install PVC conduit on non-metallic interlocking spacers securely anchored to prevent movement during backfilling.
- C. Where conduit enters into underground pull or junction boxes and at all bends, change from PVC to rigid galvanized steel conduit below grade.
- D. All steel conduit in earth shall be rigid galvanized steel conduit. Wrap conduit with 3M 0.020-inch thick No. 52 "Scotchrap" vinyl plastic tape, half lapped to give a double thickness wrap. Remove all oil, grease and dirt from conduit with a suitable solvent, and clean and dry conduit before wrapping. If conduit is pre-wrapped in the shop and then cut and jointed on the job, wrap all joints on the job, overlapping pipe wrapping 3 inches on both sides of joint.

9.3 INSTALLATION OF BUILDING CONDUIT

- A. All conduits installed within the building shall conform to requirements of this Section.
- B. Run all conductors of every description in conduits unless noted or specified otherwise.
- C. In above grade locations all conduits shall be galvanized rigid steel or intermediate metal conduit where installed exposed in damp or wet locations, installed in concrete, when exposed to physical damage or where utilized for conductors over 600 volts. When installed in concrete conduit may be PVC. Elsewhere conduit shall be EMT.
- D. In areas where there are no suspended ceilings, run all conduits parallel/perpendicular to building surface planes.
- E. Conduits shall be of such size and so installed that the conductors may be drawn through without injury or excessive strain, shall be secured at cabinets and boxes, with galvanized locknuts, both inside and outside, and shall have appropriate bushings inside. Bushings shall be insulating type or insulating type with bonding ground clamps where grounding bushings are required.
- F. Join galvanized rigid steel and intermediate metal conduit with threaded couplings. Threaded conduits shall be reamed after threading, and shall be kept tightly closed at each end, and shall be kept in dry locations during construction. Conduits shall be swabbed out before conductors are pulled.
- G. Use length of flexible metal conduit not less than 12 inches long at final connections to all motors, transformers, generators, and similar devices subject to movement because of vibration or mechanical adjustment. Use 3/8" by 6'-0" flexible metal conduits for final connections to

recessed lighting fixtures. Use liquidtight flexible metal conduit, with appropriate connections, in damp or wet locations, in mechanical equipment rooms, at motor or equipment location at or near pumps, and when installed outdoors.

- H. Ground metallic conduits as required by the NEC.
- I. Provide a green grounding conductor in all conduits including PVC conduits sized as required by the NEC.
- J. Install raceways continuous from outlet box to outlet box, or cabinet, with a maximum of 150 feet between pull points. The number of equivalent 1/4 bends between pull points shall not exceed that required by the NEC.
- K. Do not install raceways within three (3) inches of hot water pipes, except where crossings are unavoidable, and then keep raceways at least 1 inch from insulation on the pipe. When possible, avoid installing raceways directly above, or in close proximity to objects operating at high temperatures.
- L. In damp or wet locations, make every effort to avoid installing raceways in a manner which will create moisture traps. Seal both ends of raceways with an approved sealing compound to prevent moisture condensation within the raceways.
- M. In systems operating at more than 300 volts between phase conductors, and where different phase conductors are to be run to a common outlet box, provide substantial barriers between adjacent devices in the box so that two different phase wires will not be in the same compartment.
- N. Join EMT with the specified type of couplings. At EMT terminations, provide insulated throat, box connectors and locknuts.
- O. Wherever raceways pass through floors, walls, penetrations, or other partitions, or through sleeves in floors, walls or other partitions, carefully fill any space between the outside of the raceway and the building material to prevent passage of air, water, smoke, and fumes. Filling material shall be a UL listed, intumescent sealant having fire/smoke resistive quality.
- P. Conduits utilized throughout the project shall not be smaller than 3/4 inch for feeders, multiple branch circuit homeruns and homeruns of conductors larger than No. 12. Individual branch circuit wiring for No. 12 conductors shall be acceptable in 1/2" conduit, i.e. 2#12, 1#12G, 1/2" C.

9.4 INSTALLATION OF PULL AND JUNCTION BOXES

- A. Size all pull and junction boxes in accordance with the NEC. Use larger sizes than required by code where job conditions so indicate.
- B. Fasten all boxes securely to the building construction, independent of conduit systems.
- C. On concealed conduit systems where boxes are not otherwise accessible, set boxes flush with finished surfaces for access, and provide overlapping covers.

9.5 INSTALLATION OF OUTLET BOXES

- A. Terminate conduits at a metal outlet box at each outlet or device. All boxes shall conform to the NEC.

9.6 INSTALLATION OF PULL CORD (OR WIRES)

- A. Provide a pull cord (or wire) in every empty raceway, not containing conductors to be installed under this Division, to facilitate future installation of wiring. Cord shall be free from splices and shall have 12 feet of exposed length at each end. Coil and identify each end of each line with plastic tag bearing complete information as to the purpose of the raceway and the location of its other end.

9.7 INSTALLATION OF CONDUIT HANGERS AND SUPPORTS

- A. Furnish and install all hangers and supports required by the raceway systems. Refer to Section 16190 for additional requirements.
- B. Support all above-grade electrical conduits from the building construction. Support conduits running vertically or horizontally along walls with galvanized malleable iron one-hole clamps. Carry individually supported horizontal conduits 1-1/4 inch and larger on suspension hangers.
- C. Where multiple raceways are run vertically or horizontally at the same elevations, they shall be supported on trapezes formed of sections of metal framing, suspended on rods. Size trapeze

members, including the suspension rods, based on the support required for the number, size, and loaded weight of the conduits. Space them as required for the smallest conduit to be supported.

- D. Locate hangers and trapezes to support horizontal raceways without appreciable sagging. Hanger spacing shall not exceed NEC requirements, or recommendations of the NECA "Standard of Installation."
- E. Where local branch circuit conduits smaller than 1-1/4" are installed above metal lath and plaster ceilings or mechanically suspended dry ceilings of the non-removable type, they may be supported on ceiling runner channels. Where multiple conduits are passing through they shall be supported on trapeze hangers.
- F. Where local branch circuit conduits smaller than 1-1/4" are installed above removable type dry ceilings, support them on suitable hanger rods with metal clips at a distance above the ceiling sufficient to permit removal of ceiling panel and lighting fixtures. (Do not secure them to ceiling hanger rods.) Locate such conduits so as not to hinder access to mechanical equipment through ceiling panels. Where multiple conduits are passing through they shall be supported on trapeze hangers.
- G. Where support anchors are required, establish their type and locate in concrete construction before concrete is poured, if possible. Fit each hanger rod with a nut at its upper end, and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.

9.8 INSTALLATION OF SURFACE METAL RACEWAY

- A. Firmly secure raceway components to building surfaces using plastic expansion shields and flathead sheet metal screws for plaster, plastic expansion shields and flathead wood screws for drywall or masonry lead expansion shields for brick, cinder block and concrete construction.
- B. Raceways shall be run perpendicular and parallel to building surfaces with boxes set plumb and square.
- C. Install surface metal raceway only where specifically called for on the Drawings.

9.9 SEGREGATION OF WIRING SYSTEMS

- A. Segregation of wiring systems shall not be compromised by the use of common pullboxes, wireways, cabinets or any other type of enclosure.
- B. The raceway system for each feeder shall be a separate system completely fault isolated from all other raceway systems.
- C. The raceway system for the branch circuits of each panelboard shall be a separate system completely fault isolated from all other raceway systems.

9.10 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

9.11 CLEANING

- A. All conduit and boxes stores on the job shall have end caps and shall be kept clean inside and outside during the duration of the construction.
- B. After installation, keep ends plugged until boxes are closed.
- C. Clean entire raceway system prior to installation of conductors and/or pull cords.

End of Section

SECTION 16140 - WIRING DEVICES

PART 10 - GENERAL

10.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Comply with Division 16 Sections, as applicable. Refer to other Divisions for coordination of work.

10.2 SUMMARY

- A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of wiring devices, including related systems and accessories.

10.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. TVSS: Transient voltage surge suppressor.

10.4 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 1 for products specified under PART 2 - PRODUCTS.

10.5 QUALITY ASSURANCE

- A. The wiring devices specified herein shall be designed, manufactured, tested and installed according to the latest version of the following standards:
 - 1. National Electrical Manufacturers Association (NEMA) WD-1.
 - 2. Federal Specification (FS) WS-596.
 - 3. Federal Specification (FS) WS-896.
 - 4. Underwriters Laboratories (UL).
- B. All wiring devices shall be UL listed.

PART 11 - PRODUCTS

11.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc.
 - b. GE Company; GE Wiring Devices.
 - c. Hubbell, Inc.; Wiring Devices Div.
 - d. Killark Electric Manufacturing Co.
 - e. Leviton Manufacturing Co., Inc.
 - f. Pass & Seymour/Legrand; Wiring Devices Div.
 - 2. Poke-through, Floor Service Outlets and Telephone/Power Poles:
 - a. American Electric.
 - b. Hubbell, Inc.; Wiring Devices Div.
 - c. Pass & Seymour/Legrand; Wiring Devices Div.
 - d. Square D Co.
 - e. Wiremold.

11.2 RECEPTACLES

- A. Receptacles shall be standard or decorative style as indicated herein. They shall be constructed of high-impact resistant thermoplastic material with a nylon face and thermoplastic

back body. Unless noted otherwise, they shall be 2-pole, 3-wire with a green equipment ground screw or an automatic grounding system attached to the strap.

- B. Receptacle color shall be ivory unless noted otherwise.
- C. Specification grade receptacles shall be standard style. The face shall be constructed of a high-impact resistant thermoplastic. The contacts shall be a triple-wipe, t-slot, one-piece copper alloy design. The device shall have a green ground screw or an automatic grounding system attached to the strap. The device shall be 20-ampere, 125-volts, NEMA configuration 5-20R, back and side-wired.
- D. Special purpose receptacles shall be of the specific NEMA configuration indicated on the Drawings.
- E. Ground fault circuit interrupter (GFCI) receptacles shall be a feed-through type wired for single receptacle protection thus not affecting receptacles downstream on the same circuit. They shall be UL rated Class 1 with 5-milliampere ground fault trip level and a 20-ampere feed-through rating. GFCI receptacles shall be NEMA configuration 5-20R.

11.3 SWITCHES

- A. Switches shall be toggle or decorative rocker type as indicated herein. The body of the switch shall be made of an arc-resistant thermoset material. All toggle switch handles shall be constructed of a thermoplastic material. All rocker switch handles shall be constructed of a thermoset material. All wall switches shall be of the quiet AC type.
- B. Switches shall be SPST, DPST, 3-way or 4-way as indicated on the Drawings.
- C. Switch color shall be ivory unless noted otherwise.
- D. Specification grade switches shall be toggle type. The contact arms shall be made of one-piece copper alloy material. The switch shall include a green ground screw attached to the mounting strap. The switch shall be 20-ampere, 120/277-volt AC, horsepower rated, back and side-wired.

11.4 WALL PLATES

- A. Wall plates shall be provided for all switches, receptacles, blanks, telephone and special purpose outlets. The wall plates shall be of suitable configuration for the device for which it is to cover with color matched mounting screws. Color of the wall plates shall match the device, unless noted otherwise.
- B. Wall plates shall be plastic. They shall be thermoplastic, non-combustible and high-impact resistant. They shall be P-line smooth plates.
- C. Weatherproof: Wiring devices in wet and damp locations shall be installed with a hinged outlet cover/enclosure clearly marked "Suitable for Wet Locations While in Use" and "UL Listed." There shall be a gasket between the cover/enclosure and the mounting surface, and between the hinged cover and mounting plate/base to assure proper seal. The cover/enclosure shall employ stainless steel mounting hardware and be constructed of impact resistant polycarbonate. The cover/enclosure shall be specification grade as manufactured by Taymac Corporation or equal.

11.5 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

11.6 POKE-THROUGH ASSEMBLIES

- A. Description: Factory-fabricated and -wired assembly of below-floor junction box unit with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 1. Size: Selected to fit nominal 3-inch (75-mm) cored holes in floor and matched to floor thickness.
 2. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

3. Wiring: Three No. 12 AWG power and ground conductors; one 75-ohm coaxial telephone/data cable; and one four-pair, 75-ohm telephone/data cable.

11.7 FINISHES

- A. Color: Manufacturers standard, as selected by Architect.

PART 12 - EXECUTION

12.1 INSTALLATION

- A. Each wiring device shall be mounted in a metallic outlet box. In general, devices in finished spaces shall be flush mounted and devices in unfinished spaces, i.e. mechanical and electrical equipment rooms, shall be surface mounted. Verify the requirements of all spaces with the Architect.
- B. Wall plates:
 1. Each device shall have a cover plate appropriate for the application.
 2. Cover plates shall be installed true and plumb with building lines, mortar joints and architectural features.
 3. Adjacent devices shall be mounted under a common cover plate suitable for the application.
- C. Mount receptacles and special systems outlets above finish floor to the device centerline, unless noted or required otherwise.
- D. Place conductor under wiring device screw terminals and draw up snugly.
- E. Mount switches above finish floor to the device centerline and 6" from a door strike, unless noted or required otherwise.
- F. Grounding continuity shall be maintained between devices and metallic raceway system in addition to the green equipment grounding conductor run with circuit conductors.
- G. Wire each receptacle using correct polarity (i.e., neutral to neutral terminate, etc.)
- H. Mount receptacles throughout the project with ground pole at the top of the configuration when mounted vertically, on the right when horizontally mounted.
- I. All exterior wiring devices shall be provided with a weatherproof cover/enclosure. Exterior receptacles shall be GFCI type.

12.2 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

12.3 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

12.4 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

End of Section

SECTION 16511 - INTERIOR LIGHTING

PART 13 - GENERAL

13.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

13.2 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

13.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 1. Dimensions of fixtures.
 2. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 3. Emergency lighting unit battery and charger.
 4. Fluorescent and high-intensity-discharge ballasts.
 5. Types of lamps.

13.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.

13.5 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

PART 14 - PRODUCTS

14.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Interior Lighting Fixture Schedule on the Drawings.

14.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

14.3 FLUORESCENT LAMP BALLASTS

- A. General Requirements: Unless otherwise indicated, features include the following:
 1. Designed for type and quantity of lamps indicated at full light output.
 2. Sound Rating: A.
- B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:
 1. Certified Ballast Manufacturer Certification: Indicated by label.
 2. Encapsulation: Without voids in potting compound.
 3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
- C. Ballasts for Compact Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:
 1. Type: Electronic or electromagnetic, fully encapsulated in potting compound.
 2. Power Factor: 90 percent, minimum.
 3. Operating Frequency: 20 kHz or higher.
 4. Flicker: Less than 5 percent.
 5. Lamp Current Crest Factor: Less than 1.7.
 6. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
- D. Ballasts for Compact Lamps in Nonrecessed Fixtures: Unless otherwise indicated, additional features include the following:
 1. Power Factor: 90 percent, minimum.
 2. Ballast Coil Temperature: 65 deg C, maximum.
 3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
- E. Ballasts for Low-Temperature Environments: As follows:
 1. Temperatures 0 Deg F (Minus 17 Deg C) and Above: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting temperature.

14.4 EXIT SIGNS

- A. General Requirements: Comply with UL 924 and the following:
 1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
- B. Internally Lighted Signs: As follows:
 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

14.5 EMERGENCY FLUORESCENT POWER SUPPLY UNIT

- A. External Type: Self-contained, modular, battery-inverter unit. Comply with UL 924.
 1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without entering ceiling space.
 2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
 3. Charger: Fully automatic, solid-state, constant-current type.
 4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.
 5. Housing: NEMA 250, Class 1 enclosure.

14.6 LAMPS

- A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 85 CRI, unless otherwise indicated.
- B. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.
- C. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

14.7 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.

14.8 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

PART 15 - EXECUTION**15.1 INSTALLATION**

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.

15.2 CONNECTIONS

- A. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

15.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Corrosive Fixtures: Replace during warranty period.

15.4 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

End of Section

SECTION 16521 - EXTERIOR LIGHTINGPART 16 - GENERAL

16.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

16.2 SUMMARY

- A. This Section includes exterior lighting units with luminaires, lamps, ballasts, poles/support structures, and accessories.

16.3 DEFINITIONS

- A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.
- B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

16.4 SUBMITTALS

- A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 1. Materials and dimensions of luminaires and poles.
 2. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 3. High-intensity-discharge luminaire ballasts.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

16.5 QUALITY ASSURANCE

- A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by a testing agency acceptable to authorities having jurisdiction
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

16.6 DELIVERY, STORAGE, AND HANDLING OF POLES

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on metal poles until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

PART 17 - PRODUCTS

17.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Exterior Lighting Unit Schedule on the Drawings.

17.2 LUMINAIRES

- A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

- D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.
- F. Exposed Hardware Material: Stainless steel.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
- J. Photoelectric Relays: As follows:
 - 1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
 - 2. Relay Mounting: In luminaire housing.
- K. High-Intensity-Discharge Ballasts: Comply with ANSI C82.4. Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
 - 1. Single-Lamp Ballasts: Minimum starting temperature of minus 40 deg C.
 - 2. Open-circuit operation will not reduce average life.
 - 3. Noise: Uniformly quiet operation, with a noise rating of B or better.
- L. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.
 - 1. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

17.3 LUMINAIRE SUPPORT COMPONENTS

- A. Description: Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
- B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mph (160 km/h) with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
 - 1. Strength Analysis: For each pole type and luminaire combination, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- C. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.
- D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Will not cause galvanic action at contact points.
 - 2. Mountings: Correctly position luminaire to provide indicated light distribution.
 - 3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
 - 4. Anchor-Bolt Template: Plywood or steel.
- E. Pole/Support Structure Bases: Anchor type with hold-down or anchor bolts, leveling nuts, and bolt covers.

- F. Steel Poles: Tubing complying with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in length with access handhole in pole wall.
 - G. Aluminum Poles: Fabricated from seamless, extruded structural tube complying with ASTM B 429, 6063-T6 alloy with access handhole in pole wall.
 - 1. Grounding Provisions for Metal Pole/Support Structure: Welded 1/2-inch (12-mm) threaded lug, accessible through handhole and listed for copper conductor connection.
 - H. Concrete for Pole Foundations: Comply with Division 3 Section "Cast-in-Place Concrete."
 - 1. Design Strength: 3000-psig (20.7-MPa), 28-day compressive strength.
- 17.4 FINISHES
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - B. Steel: Grind welds and polish surfaces to a smooth, even finish.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Interior: Apply one coat of bituminous paint on interior of pole, or otherwise treat to prevent corrosion.
 - 3. Polyurethane Enamel: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As indicated by manufacturer's designations.

PART 18 - EXECUTION

18.1 INSTALLATION

- A. Concrete Foundations: Construct according to Division 3 Section "Cast-in-Place Concrete."
 - 1. Comply with details for reinforcement and for anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual pole bases furnished.
 - 2. Finish for Parts Exposed to View: Trowel and rub smooth. Comply with Division 3 Section "Cast-in-Place Concrete" for exposed finish.
- B. Install poles as follows:
 - 1. Use web fabric slings (not chain or cable) to raise and set poles.
 - 2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 3. Secure poles level, plumb, and square.
 - 4. Grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space.
 - 5. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- C. Luminaire Attachment: Fasten to indicated structural supports.
- D. Lamp luminaires with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

18.2 CONNECTIONS

- A. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Ground metal poles/support structures according to Division 16 Section "Grounding."
 - 1. Nonmetallic Poles: Ground metallic components of lighting units and foundations. Connect luminaires to grounding system with No. 6 AWG conductor.

18.3 FIELD QUALITY CONTROL

- A. Inspect each installed unit for damage. Replace damaged units.
- B. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

18.4 CLEANING AND ADJUSTING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.
- B. Adjust amiable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

End of Section

NOTIFICATION OF ADDENDUM

ADDENDUM NO. 3

DATED 9/04/2002

Control	0923-06-047
Project	STP 2000(540)TE
Highway	VA
County	BROWN

Ladies/Gentlemen:

Attached please find an addendum on the above captioned project. Included in the attachment is an addendum notification which details the changes and the respective proposal pages which were added and/or changed.

Except for new bid insert pages, it is unnecessary to return any of the pages attached.

Bid insert pages must be returned with the bid proposal submitted to the Department, unless your firm is submitting a bid using a computer print out. The computer print out must be changed to reflect the new bid item information.

Contractors and material suppliers, etc. who have previously been furnished informational proposals are not being furnished a copy of the addendum. If you have a subcontractor on the above project, please advise them of this addendum. Acknowledgment of this addendum is not requested if your company has been issued a proposal stamped "This Proposal Issued for Informational Purposes."

You are required to acknowledge receipt of this addendum by entering the date, which appears at the top of this letter on the Addendum Acknowledgement Form, contained in your bid proposal.

Failure to Acknowledge receipt of this addendum in your bid proposal will result in your bid not being read.

04/99

SUBJECT: PLANS AND PROPOSAL ADDENDUMS

PROJECT: STP 2000(540)TE

CONTROL: 0923-06-047

COUNTY: BROWN

LETTING: 09/05/2002

REFERENCE NO: 0904

PROPOSAL ADDENDUMS

— PROPOSAL COVER

— BID INSERTS (SH. NO.:)

— GENERAL NOTES (SH. NO.:)

— SPEC LIST (SH. NO.:)

— SPECIAL PROVISIONS:

ADDED:

DELETED:

— SPECIAL SPECIFICATIONS:

ADDED:

DELETED:

X OTHER: ATTACHMENT TO SPECIAL SPECIFICATION 5903

DESCRIPTION OF ABOVE CHANGES

(INCLUDING PLANS SHEET CHANGES)

DIVISION 8 "DOORS AND WINDOWS"

ADDED SECTION 08710 "FINISH HARDWARE"

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Finish hardware for doors.
- B. Weatherstripping (Existing Depot door side panel).
- C. Restoring existing door hardware scheduled to be reused.

1.2 RELATED SECTIONS:

- A. Stile and rail panel doors - Section 08212.
- B. Wood door restoration - Section 08290.

1.3 REFERENCES:

- A. NBHA - Recommended Locations for Builders Hardware - 1975.
- B. NBHA - Basic Builders Hardware - October 1969.
- C. BHMA Product Standards, latest editions.

1.4 SUBMITTALS:

- A. Schedules: Submit detailed finish hardware schedule in accordance with Section 01340. Schedule shall be complete, including type, manufacturer's name and number, and finish of each item required. Include complete schedule of keying system.
- B. Samples: Submit sample of each type of finish hardware item used on project. If accepted, samples may be used on project.
- C. Templates: Furnish templates required for installation of hardware.
- D. Quality Control Submittals: For information only.
 - 1. Certification: Submit notarized certification indicating that hardware furnished for doors requiring physically handicapped access complies with requirements of governing authorities and applicable regulations.
 - 2. Installation instructions.
- E. Contract Closeout Submittals: Refer to Section 01700.
 - 1. Operating and maintenance data.
 - a. Parts catalog.
 - b. Keying records.

1.5 QUALITY ASSURANCE:

- A. Hardware Supplier:
 - 1. Recognized builders hardware supplier who has been engaged in furnishing hardware for a minimum of 5 years and has in his employ a certified Architectural Hardware Consultant (AHC), who will supervise execution of work under this Section.
 - 2. Supplier shall be available at reasonable times during course of the work, for project consultation with Owner, Architect or Contractor at the project site.
- B. Regulatory Requirements:
 - 1. State of Texas: Texas Accessibility Standard (TAS) of the Architectural Barriers Act, Article 9102, Texas Civil Statutes, April 1, 1994.
 - 2. Federal: American with Disabilities Act of 1990, Title 3 Provisions, Public Accommodations and Commercial Facilities.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Package and deliver hardware items separately and mark each to correspond with heading

numbers on hardware schedule.

- B. Include necessary instructions, templates, drawings and fasteners for proper installation. Include extra fasteners.

1.7 COORDINATION:

- A. Review Shop Drawings of related work and verify that scheduled finish hardware is suitable for each related item of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Lock Manufacturer:
 - 1. Products listed are items manufactured by Sargent and Co., and are listed as a standard of quality.
 - 2. Products of following manufacturers are acceptable subject to meeting specification requirements:
 - a. Schlage Lock Co..
 - b. Corbin / Russwin Hardware.
- B. Closer Manufacturer:
 - 1. LCN Closers.
 - 2. Rixson-Firemark, Inc.
- C. Manufacturers of Other Items:
 - 1. Butts: Hager Hinge Co., McKinney Mfg. Co., or Stanley Hardware.
 - 2. Door Pulls: Trego Industries or Quality Hardware Mfg. Co., Inc.
 - 3. Kickplates, Push Plates: Trego Industries or Quality Hardware Mfg. Co., Inc.
 - 4. Bolts: Trimco or H.B. Ives.
 - 5. Stops: Trimco or Quality Hardware Mfg. Co., Inc.
 - 6. Weatherstripping: Zero Weatherstripping Company, Pemko Mfg. Co., Reese Enterprises, Inc., National Guard or Hager Hinge Co.

2.2 MATERIALS:

- A. Screws and Fasteners:
 - 1. Provide screws and fasteners required for proper installation. Use only slotted type, flat-head screws and fasteners. Phillips head screws and fasteners are prohibited.
 - 2. Metal and finish of fasteners same as item fastened.
- B. Butts:
 - 1. Full mortise template hinges, 5-knuckle type, plain-bearing except at doors with closers or doors over 40 in. width furnish ball-bearing type.
 - 2. Furnish quantity of hinges per door as follows:
 - a. Doors up to 90 in. height - 3 butts.
 - b. Doors over 90 in. and less than 120 in. - 4 butts.
 - 3. Furnish hinge sizes as follows for 1-3/4 in. doors:
 - a. Up to 3'-0" wide - 4-1/2 x 4-1/2.
 - b. Over 3'-0" to 3'-4" wide - 5 x 4-1/2.
 - c. Over 3'-4" wide - heavy 5 x 4-1/2.
 - d. Width of hinges adjusted as required to clear adjacent trim.
- C. Locksets and Latchsets:
 - 1. Qualities: Heavy duty key-in-lever bored locks, through bolted installation.
 - a. Independent lever return springs.
 - b. Levers rotate in one direction.

- c. Cast lever with wrought rose.
- d. Comply with UL requirements for throw of latches on rated fire openings
- e. Backsets and strike types as required by conditions. Furnish curved lip type strikes.
- f. Function as listed on schedule (function identification numbers of BHMA-PS).
- 2. Standards: ANSI A156.2, Series 4000, Grade 1.
- 3. Source: Sargent 10-Line, LB trim.
- D. Mortise Deadlocks: Sargent 4870 line, function as listed on schedule (function identification numbers of BHMA-PS). Strike types as required by conditions.
- E. Overhead Door Closers: Fully hydraulic, full rack and pinion action with a high strength cast iron cylinder. Furnish complete with metal covers, forged steel arms, necessary brackets and thru-bolt fasteners. Top of door mounting. Provide parallel arms where required to prevent closer from being on corridor side of door, where wall stop mounting requires 180 degrees door swing, and where required to prevent closer from being on exterior of building. Furnish other scheduled accessories.
 - 1. Interior Closers: LCN 4030 and 4130 Series closers, sized in accordance with manufacturer's recommendations.
 - 2. Accessible Closers: LCN 4041 Series non-handed, non-sized closers at doors requiring handicapped access. Adjust to comply with TAS requirements.
- F. Interior Stops: Quality No. 311-Alum. floor-type cast dome stop. Where floor stops cannot be used, furnish overhead door stop.
- G. Overhead Door Holders: Sargent 590 Series or GJ300.
- H. Kickplates: 16-ga., 8 in. high, length equal to door width less 2 in. Furnished on one side of door, unless otherwise scheduled.
- I. Cylinders: Sargent Series 42, type required for lockset, unless otherwise noted.
- J. Interior Door Pull: Trego No. PP602 x P150, cast pull with wrought 16 ga. formed plate.
- K. Push Plates: Trego No. PP602 wrought 16 ga. formed push plate.
- L. Rubber Silencers: NTQuality No. 1337B. Provide 3 rubber silencers at each strike jamb.
- M. Sill Weatherstrip: No. 926 closed cell foam with pressure-sensitive adhesive by Zero.

2.3 FINISHES:

- A. Butts: US10B.
- B. Locksets and Related Trim: US10B.
- C. Closers: Paint to match US10B.
- D. Pulls, Plates and Misc.: US10B.

2.4 KEYING:

- A. Key, masterkey and grandmaster key to match existing keyway in accordance with Owner's requirements and approved keying schedule. Furnish 2 change keys for each lock.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION:

- A. Examine door frames and related items for conditions that would prevent proper application of finish hardware.
- B. Do not proceed until defects are corrected.
- C. Clean and refinish existing hardware scheduled to be reused. Remove dirt, grime and grease. Repair operating hardware items to smooth, operating condition, free of binds.

3.2 INSTALLATION:

- A. Securely install finish hardware items in accordance with approved schedule and templates furnished with hardware.

- B. Install mortised items flush with adjacent surfaces.
- C. Install locksets, closers and trim after finish painting.
- D. Locate items in accordance with NBHA "Recommended Locations for Builder's Hardware", unless otherwise noted.
- E. Test and adjust hardware for quiet, smooth operation, free of sticking, binding or rattling. Adjust closers for proper, smooth operation. Adjust handicapped accessible closers to meet specified opening force criteria.
- F. At final completion, properly tag and identify keys and deliver to Owner.

3.3 FINISH HARDWARE SCHEDULE:

- A. Furnish each door leaf with hardware items scheduled in hardware set. Furnish size, type and quality as specified in Article 2.2. Furnish specific function or component as scheduled below, or as required to function with specific door details.

Set No. 1

- Butts
- Passage Set - F75 function
- Closer
- Kickplates
- Overhead stop
- Rubber silencers

Set No. 2

- Butts
- Lockset - F81 function
- Closer
- Stop
- Rubber Silencers

Set No. 3

- Butts
- Closer w/ parallel arm
- Pull
- Pushplate
- Kickplate
- Stop
- Rubber silencers

Set No. 4

- Reuse existing butts
- Lockset - F81 function

Set No. 5

- Butts
- Lockset - F81 function
- Stop

Set No. 6

- Reuse existing butts and lockset.

Mortise Deadbolt

Set No. 7

Reuse existing butts and lockset.

Set No. 8 (Existing Depot Door Side Panels)

Sill weatherstripping

End of Section

